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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

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FINAL REPORT

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TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

MANAGER, INDUSTRIAL ORGANIZATION O-97.41

B-422 or S-155

TM 001 500

U. S. Employment Service in
Cooperation with
New York State Employment Service

U. S. DEPARTMENT OF LABOR
Bureau of Employment Security
Washington 25, D. C.
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GATB #2237C
1957

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR MANAGER, INDUSTRIAL ORGANIZATION O-97.41

B-422

Summary

The General Aptitude Test Battery was administered to a total sample of 70 students attending a two-year Scientific Management Course at the Fashion Institute of Technology, New York, New York. This is a junior-college-level school chartered by the Board of Regents of the University at the State of New York and operated by the New York City Board of Higher Education. The sample consisted of 41 students who were tested during the school year 1947-1948 with the B-1001 edition of the GATB and 29 students who were tested during the school year 1956-1957 with the B-1002 edition of the GATB. The criterion consisted of grade-point averages for all subjects in the course. On the basis of mean scores, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes G-Intelligence, V-Verbal Aptitude, and S-Spatial Aptitude were selected for inclusion in the test norms.

GATB Norms for Manager, Industrial Organization O-97.41 - B-422

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Manager, Industrial Organization O-97.41.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for B-422

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
G	CB-1-H CB-1-I CB-1-J	100	G	Part 3 Part 4 Part 6	95
V	CB-1-J	100	V	Part 4	100
S	CB-1-F CB-1-H	105	S	Part 3	100

Effectiveness of Norms

The data in Table IV indicate that 15 of the 23 poor students, or 65 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 65 percent of the poor students would not have been chosen if the recommended test norms had been used in the selection process. Moreover, 38 of the 46 students who made qualifying test scores, or 83 percent, were good students.

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Manager, Industrial Organization 0-97.41.

II. Sample

The GATB, B-1001 was administered during the school year 1947-1948 to a group of 41 students (40 males and 1 female) in the Scientific Management Course at the Fashion Institute of Technology, New York, New York. During the school year 1956-1957 the GATB, B-1002A, was administered to another group of 29 students (26 males and 3 females) at this school. The two groups were combined into a total sample of 70 students (66 males and 4 females). All the 70 students had completed the two-year course at the school.

Table II shows the means, standard deviations, ranges, and Pearson product-moment correlations with the criterion for age.

TABLE II

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age

Manager, Industrial Organization 0-97.41
N = 70

	M	σ	Range	r
Age (years)	21.6	3.1	18-30	.461**

** Significant at the .01 level

The correlation between age and the criterion is significant at the .01 level. Careful consideration was given to this fact. Partial correlations for the aptitudes and the criterion holding age constant were computed. The correlation showed that there was no appreciable change in the pattern of the significant aptitudes.

III. Job and Course Descriptions

Job Title: Manager, Industrial Organization 0-97.41

Job Summary: Coordinates the operation of production, distribution, and selling departments. Determines administrative policies, and executes them through subordinates for the efficient management of an industrial corporation.

Course Description

The objectives of the Scientific Management course are made clear by the following excerpt from the Fashion Institute of Technology bulletin:

> "The sequence of studies in scientific management prepares graduates for positions in which a knowledge of apparel technology as well as economic and business judgment are required. Initially, such positions as time-study man, foreman, management engineer's assistant, and assistant to a plant manager may be expected. Experience in operation should lead qualified students to such positions as plant managers, management engineers, consultants, or eventually, to become heads of their own concerns."

The training received in the Scientific Management Course is related throughout to the practices and problems of the Needle-Trade Industry. A detailed summary follows:

Majors:

General Management: Studies the overall history, techniques, and problems in the field of general management in the apparel industry--including seminar on management problems.

Production Management: Analyzes the problems of plant engineering relating to the selection and installment of production equipment and other physical facilities for effective manufacture. Receives study and practice in motion and time study, using process charts, micro-motion analyses and the principles of work simplification. Acquires knowledge of the theory and application of production and quality control and planning from sales forecasting through production, material and labor budgets, purchasing, routing, scheduling, dispatching and control. Uses visible index, punched card systems, Gantt charts and production control boards. Studies plant layout and various methods of apparel production. Acquires practice in the use of operation and flow process charts, single and three-dimensional templates, laying out and re-laying out plants.

Financial and Sales Management: Studies and applies the principles of business economics (including cost estimating, pricing) to marketing from the viewpoint of the needle trades manufacturer. Acquires a knowledge of business law.

Personnel Management: Studies and carries out research projects in modern personnel management particularly as pertinent to the small apparel manufacturer, including the areas of selection, training, motivation, and personnel records. Considers the principles of the area wage, systems of job evaluation, wage determination, and incentives.

Related Technical Courses:

Apparel Construction: Studies the principles of apparel construction in relation to price range, labor and costs.

Sewing Technology: Becomes familiar with the use of machine techniques in apparel manufacture--sewing machines, folders, sewing attachments, and machine repair.

Cutting Technology: Studies the theory and acquires practice in the preparation of markers, spreading the lay, and actual cutting--with stress on optimum cloth economy.

Textile Technology: Learns the classification of fibers, construction of basic weaves, and methods of dyeing and printing. Studies chemical and physical testing of textiles. Acquires ability in identification of raw material, construction, color and finish, working properties, launderability, etc.

Tool Courses: Studies and acquires practice in basic elements of cost accounting and record procedures applicable to the needle trades; the interpretation and uses of business statistics; the essentials of drafting--conveying of structural ideas in the form of a blue print on sketch.

Academic and Cultural Courses:

Report Techniques (oral and written)
Sociology
Economics
Industrial Psychology
History

IV. Experimental Battery

All the parts of the GATB, B-1001, were administered to the 1947-1948 class and all the parts of the GATB, B-1002A, were administered to the 1956-1957 class.

V. Criterion

The criterion used for this study consisted of grade-point averages for the entire two-year course. The averages were based on grades received for all subjects including those not directly related to the specific tasks of the job. The grade-point average was computed by multiplying the number of hours per week by the grade value of the mark in each subject, and dividing by the total number of hours:

Mark		Grade Value
Honor	- 95-100	4
Good	- 85-94	3
Satisfactory	- 75-84	2
Low	- 70-74	1
Failure	- Below 70	0

The distribution of grade-point averages ranged from 1.87 to 4.00 with a mean of 2.76 and a standard deviation of .50. The reliability of the criterion was determined by correlating the grades achieved for the first and third terms with those achieved for the second and fourth terms. The obtained coefficient of correlation was .86; application of the Spearman-Brown Prophecy formula raises this correlation to .93.

VI. Statistical and Qualitative Analyses

A. Statistical Analysis:

Since the 1948 class of 41 students was tested with the B-1001 edition of the GATB, the scores for the 41 students were converted to equivalent B-1002 scores by the use of Table IV entitled Equivalent GATB Scores on B-1001 and B-1002, dated December 1953. (This table was developed by the Testing Division, Bureau of Employment Security.)

Table III shows the means, standard deviations, and Pearson produce-moment correlations with the criterion for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general working population norms with a mean of 100 and a standard deviation of 20.

TABLE III

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

Manager, Industrial Organization O-97.41
N = 70

Aptitudes	M	σ	r
G-Intelligence	121.5#	15.2	.524**
V-Verbal Aptitude	117.5#	16.4	.387**
N-Numerical Aptitude	118.0#	12.6	.270*
S-Spatial Aptitude	114.7	22.6	.458**
P-Form Perception	113.5	14.4	.165
Q-Clerical Perception	110.5	13.6	.167
K-Motor Coordination	112.6	14.0	.112
F-Finger Dexterity	102.3	15.3	-.126
M-Manual Dexterity	104.4	21.6	.121

** Significant at the .01 level
* Significant at the .05 level
# Relatively high mean score

The highest mean scores in descending order of magnitude were obtained for Aptitudes G, N, and V respectively. All the aptitudes, except Aptitudes S and M have standard deviations of less than 20. Aptitude N has the lowest standard deviation. For a sample of 70 cases, correlations of .307 and .236 are significant at the .01 level and the .05 level of confidence, respectively. Aptitudes G, V, and S correlate significantly with the criterion at the .01 level. Aptitude N correlates significantly with the criterion at the .05 level.

B. Qualitative Analysis:

The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation.

Intelligence (G) - required to learn and understand the overall techniques and problems in the field of management and to analyze management problems.

Verbal Aptitude (V) - required for facility of expression in studying and carrying out research projects in management and for reading comprehension.

Numerical Aptitude (N) - required to interpret and use business statistics, cost accounting, pricing, etc. Also required to analyze time and motion study data, and production and quality control.

Form Perception (P) - required to learn textile technology such as the classification of fibers, construction of basic weaves and identification of raw material.

Spatial Aptitude (S) - required to analyze problems of plant engineering and installation of production equipment. Also required to use templates; to learn the essentials of drafting and to study plant layout.

C. Selection of Test Norms:

Based on the quantitative and qualitative evidence cited above, Aptitudes G, V, N, and S warranted further consideration for inclusion in the test norms. The evidence for each of these aptitudes is indicated below.

Aptitude	Relatively High Mean Score	Significant Correlation with the Criterion	Importance Indicated by Qualitative Analysis
G	X	X	X
V	X	X	X
N	X	X	X
S		X	X

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Various combinations of Aptitudes G, V, N, and S with appropriate cutting scores were selected as trial norms. The relationship between each set of trial norms and the criterion (dichotomized as indicated in section VII) was determined.

A comparison of the results showed that B-1002 norms consisting of G-95, V-100, and S-100 had the best selective efficiency.

In test development studies an attempt is made to develop a set of norms such that the cutting score for each aptitude included in the norms will be set at a five-point score level close to one standard deviation below the aptitude mean of the experimental sample. Adjustments of cutting scores from one standard deviation below the mean are made to effect better selective efficiency of the norms. In this study the aptitude cutting scores are each within 12 points of one standard deviation below the aptitude mean of the sample.

VII. Concurrent Validity of Norms

For the purpose of computing the tetrachoric correlation coefficient between the test norms and the criterion and applying the Chi Square test, the criterion was dichotomized by placing approximately one-third of the sample in the low criterion group. This was accomplished by setting the grade-point average of 2.48 as the criterion critical score and resulted in 23 of the 70 students, or 33 percent of the sample, being placed in the low criterion group.

Table IV shows the relationship between test norms consisting of Aptitudes G, V, and S with critical scores of 95, 100, and 100, respectively, and the dichotomized criterion for Manager, Industrial Organization O-97.41. Students in the high criterion group have been designated as "good students" and those in the low criterion group as "poor students."

TABLE IV

Relationship between Test Norms Consisting of Aptitudes G, V, and S with Critical Scores of 95, 100, and 100, Respectively, and the Criterion for Manager, Industrial Organization O-97.41

N = 70

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Students	9	38	47
Poor Students	15	8	23
Total	24	46	70

$r_{tet} = .68$ $\quad X^2 = 12.574$

$\sigma_{r_{tet}} = .20$ $\quad 9\ P/2 < .0005$

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

VIII. Conclusions

On the basis of mean scores, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes G, V, and S with minimum scores of 95, 100, and 100, respectively, are recommended as B-1002 norms for the occupation of Manager, Industrial Organization 0-97.41. The equivalent B-1001 norms consist of G-100, V-100, and S-105.

IX. Determination of Occupational Aptitude Pattern

When the specific test norms for an occupation include three aptitudes, only those occupational aptitude patterns which include the same three aptitudes with cutting scores that are within 10 points of the cutting scores established for the specific norms are considered for that occupation. The only one of the existing 23 occupational aptitude patterns which meets these criteria for this study is OAP-18 which consists of G-100, V-100, and S-90 for B-1002 and G-105, V-100, and S-95 for B-1001. The selective efficiency of OAP-18 for this sample was determined by means of the tetrachoric correlation technique. A tetrachoric correlation of .44 with a standard error of .21 was obtained, which indicates a significant relationship between OAP-18 and the criterion for this experimental sample. The proportion of the sample screened out by OAP-18 was .27, which is within the required range of .10 to .60. Therefore, it is recommended that OAP-18 be used in counseling for the occupation of Manager, Industrial Organization 0-97.41.